

Evaluating the Use of Granular Activated Carbon

An Option to Comply with New EPA Drinking Water Standards for Los Angeles County Waterworks Districts 37 and 40

Background

Los Angeles County Waterworks is working with the Antelope Valley East Kern Water Agency (AVEK) to comply with upcoming changes in drinking water quality standards set by the U.S. Environmental Protection Agency (EPA). The EPA develops rules to protect public health. The EPA periodically updates their rules related to drinking water to balance emerging risks, and they recently updated rules associated with disinfection byproducts (DBPs). Public drinking water providers all over the country are evaluating and modifying their facilities to meet EPA's *Stage 2 Disinfection Byproducts Rule*. According to the EPA this rule "strengthens public health protection for customers by tightening compliance monitoring requirements for two groups of DBPs, trihalomethanes (TTHM) and haloacetic acids (HAA5)."¹

What are disinfection byproducts (DBPs)?

The EPA describes disinfection byproducts as follows: "Disinfectants are an essential element of drinking water treatment because of the barrier they provide against waterborne disease-causing microorganisms. Disinfection byproducts (DBPs) form when disinfectants used to treat drinking water react with naturally occurring materials in the water (e.g., decomposing plant material).

Total trihalomethanes (TTHM) and haloacetic acids (HAA5) are widely occurring classes of DBPs formed during disinfection with chlorine and chloramines. The amount of trihalomethanes and haloacetic acids in drinking water can change from day to day, depending on the season, water temperature, amount of disinfectant added, the amount of plant material in the water, and a variety of other factors."²

When do the new standards become effective?

The deadlines for compliance are based on the sizes of the public water systems. The Stage 2 Compliance Monitoring must begin between April 2012 and October 2014.

How do these community meetings fit into the process for compliance?

This series of community meetings being hosted in December 2009 follow a number of important events leading toward the compliance of the EPA Stage 2 Compliance Monitoring requirements.

¹ See EPA Fact Sheet 815-F-05-003, December 2005 at http://www.epa.gov/OGWDW/disinfection/stage2/pdfs/fs_st2_finalrule.pdf

² See EPA Fact Sheet cited above.

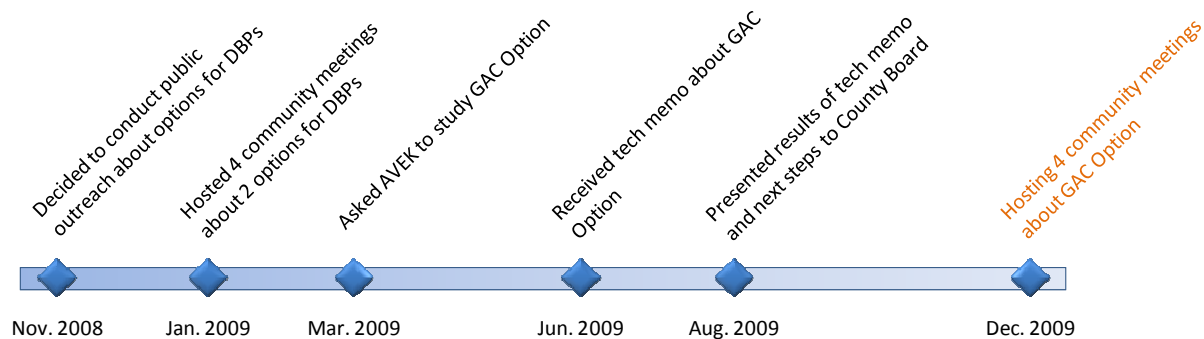


Figure 1 - L.A. County Department of Public Works Steps toward Compliance

- In 2005, Antelope Valley East Kern Water Agency (AVEK) staff made recommendations to their Board of Directors to modify their treatment process, including changes to their disinfection system, to meet the upcoming more stringent EPA standards. (As of June 2009, AVEK was nearing completion of their DBP Control Project.)
- On November 5, 2008, the Los Angeles County Board of Supervisors directed the Department of Public Works to conduct a public outreach effort throughout the Antelope Valley to present information on available disinfection options to meet the new EPA DBPs standard and report back to the Board within 120 days.
- In January 2009, four community meetings were conducted in Acton, Lancaster, Palmdale, and Lake Los Angeles. The Waterworks' staff gave presentations, covering regulatory requirements, health effects of THMs, and two available disinfection options to comply with the new DBPs standard and the advantages and disadvantages of each option.
- On March 11, 2009, the Department submitted a report to the Board of Supervisors describing the public outreach effort and summarizing the feedback received during the community meetings. The report recommended that the Department initiate discussions with AVEK on the potential to use of granular activated carbon (GAC) to remove organic material, followed with chlorine as a secondary disinfectant and report back to the Board with an implementation action plan within 120 days.
- On May 26, 2009, MWH Consulting Engineers presented updated information on the feasibility and potential cost of installing GAC contactors followed by secondary disinfection using chlorine to AVEK's Board of Directors.
- On June 10, 2009, the Department received a copy of MWH Consulting Engineers' technical memorandum.
- On August 5, 2009, The Department submitted a memo to the Board of Supervisors summarizing the MWH Consulting Engineers' technical memorandum and outlining implementation action steps. The memo recommended that the Department conduct outreach to inform customers of the results of the MWH Consulting Engineers' technical memorandum, associated potential rate increases, and to verify customers' preferred method of disinfection.

- Four community meetings are being hosted in December 2009 in Palmdale, Acton, Lake Los Angeles, and Lancaster to discuss the potential for implementing GAC.
- The Department plans to conduct a professional telephone survey of customers to gauge customer opinion about potential changes to the water treatment system and associated rate changes after completing the community meetings in December.
- The Department plans to report back to the Board and recommend a preferred treatment method to meet the DBP standards in February 2010 based on the results of the community meetings and the telephone survey.

Lowering Regulated Disinfection Byproducts

As mentioned above, disinfection byproducts (DBPs) form when disinfectants react with specific substances dissolved in the water being treated. EPA's *Stage 2 Disinfection Byproducts Rule* targets trihalomethanes and haloacetic acids. These compounds are formed by the interaction of chlorine with organic material in the water. Concentrations of these regulated byproducts can be reduced by using a disinfectant less reactive with organic material or by removing a portion of the organic material that reacts with the chlorine. Figure 2 illustrates that AVEK currently uses ozone as the primary disinfectant and chlorine as the secondary disinfectant. Given the average level of organic material contained in water delivered from the State Water Project, this approach will not meet EPA's *Stage 2* requirements.

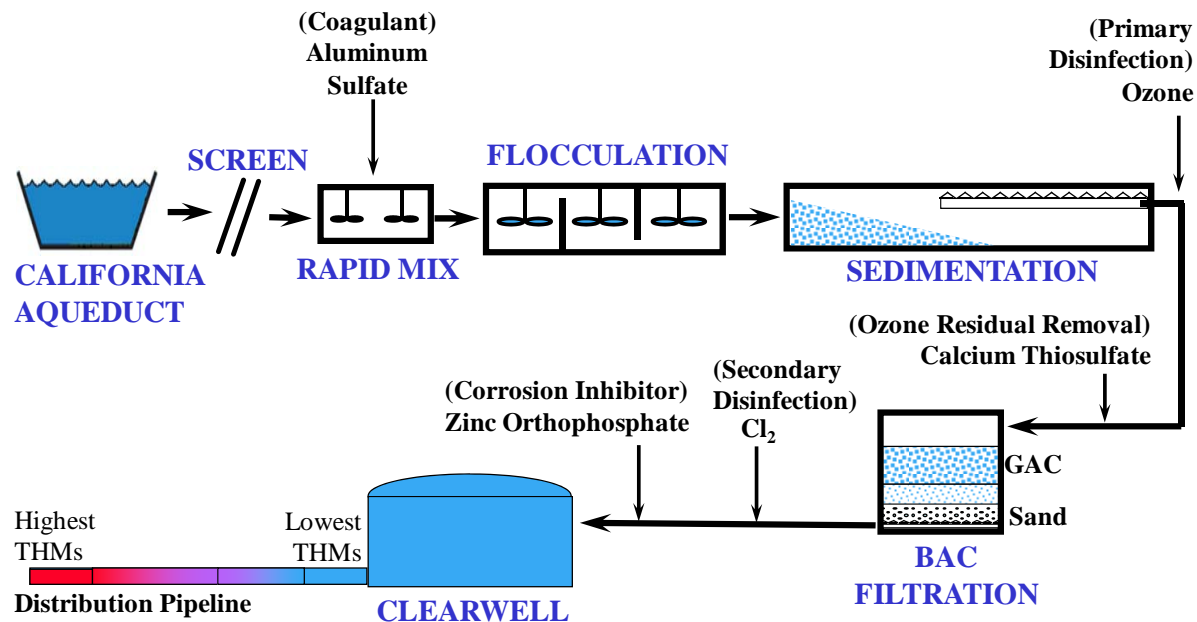


Figure 2 – Current AVEK Water Treatment Process

The proposed approach being discussed at this time (referred to as the GAC Option) to meet the new DBPs standards is to remove a portion of the organic material in the water using granular activated carbon contactors before adding chlorine to provide a disinfectant residual in the distribution system.

(Proposed changes are shown in Figure 3 with green labels.) This proposed approach would require significant construction to add sufficient GAC contactors and their associated support facilities.

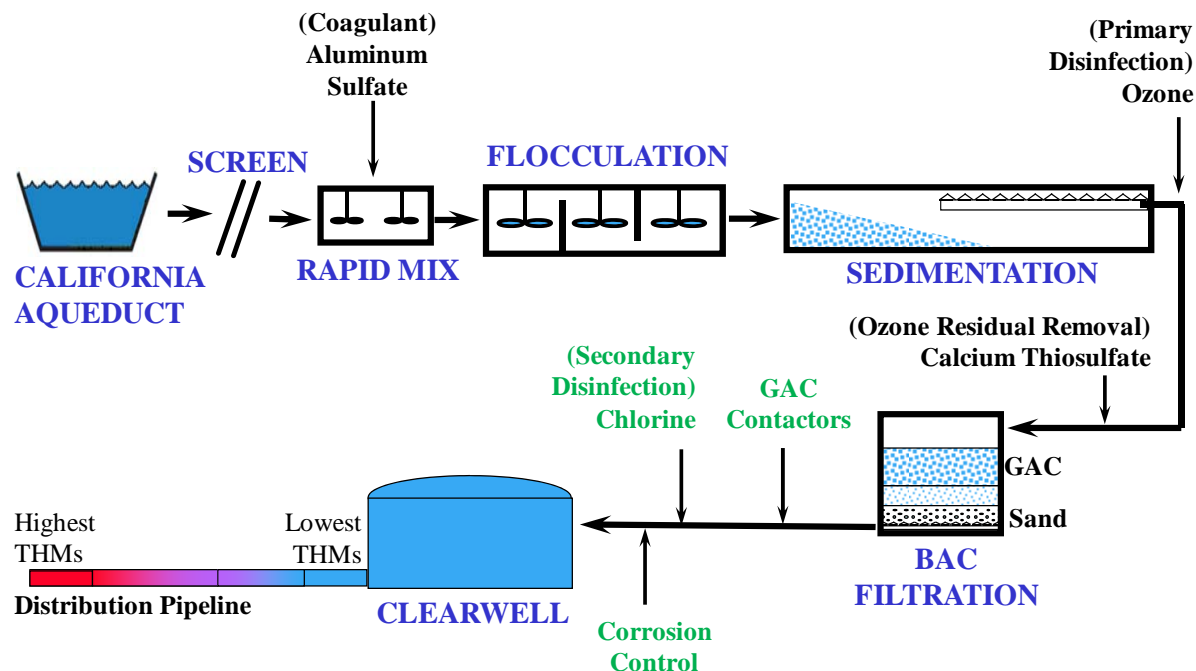


Figure 3 – Proposed AVEK Water Treatment Process with GAC Option

Evaluating Granular Activated Carbon Option

A technical memo dated June 10, 2009 prepared by the consulting firm MWH (a firm with extensive expertise and experience in design of water treatment facilities) evaluates the feasibility of integrating post-filtration granular activated carbon (GAC) into the water treatment process for AVEK's four water treatment plants to meet EPA's *Stage 2 Disinfection Byproducts Rule*. The technical memo presents several key findings:

- Based on a conceptual level design, it appears to be technically feasible to modify the water treatment infrastructure to add sufficient GAC contactors and make associated modifications required to support operations and maintenance of the new contactors at each of AVEK's water treatment plants to meet the *Stage 2 Disinfection Byproducts Rule*.
- Implementation of this option would require capital investment for contactor vessels, new pump stations, civil and site work, piping, and electrical. These capital costs are estimated to be approximately \$70 million.
- Implementing the GAC Option would require between 36 and 42 months to complete.
- The adsorption capacity of the GAC diminishes over time when in use, and has to be changed periodically to continue to provide adequate DBP precursor removal. The frequency of replacement can vary significantly depending on the condition of the water being treated. In

particular, higher concentrations of bromide in the water can significantly shorten the useful life of the GAC and require much more frequent replacement.

- The estimated operation and maintenance costs for the GAC Option in an average year is approximately \$18 million dollars, with 90% of the operation cost going to GAC replacement (~ \$16.3 million for GAC replacement cost in an average year).
- During periods of high bromide concentrations in the water delivered from the State Water Project, GAC consumption could increase by more than 80% (19 million pounds in a year with high bromide concentrations as compared to 11 million pounds of GAC in an average year).
- Based on the estimated capital costs and average operation and maintenance costs, the average cost of water treated to meet the new DBP standard will increase by \$270 per acre foot. If this additional cost is added to current AVEK rates, the new rates for municipal and industrial suppliers would be \$595 per acre foot. (This represents an 83% increase over the 2009 average wholesale price of \$325 per acre foot AVEK charges municipal and industrial suppliers.)
- The costs of purchasing GAC and disposing GAC are variable and closely tied to the price of energy for manufacture and transport.
- Over 50% of currently available GAC is imported from outside the U.S.
- If AVEK implements this option, they will become the largest known public user of GAC west of the Mississippi River.
- Use of GAC at AVEK is estimated to consume roughly 120,000 mwh of power and generate about 100,000 metric tons of carbon dioxide each year.

Water Rate Increases

If the GAC treatment is implemented for all of AVEK's water treatment plants, the increase in AVEK wholesale water rates would result in a recommendation to the County Board of Supervisors to consider a rate increase for Districts 37 and 40. If the post-filtration GAC option is implemented, more detailed financial studies will be required. However, based on the preliminary estimates for expected average conditions, the Department estimates a need to increase the bimonthly rates by 46% in Waterworks District 37 and 51% in Waterworks District 40. This would result in a \$53 increase in the bimonthly bill for an average customer in District 37 (from \$116 to \$169) and a \$38 increase for an average customer in District 40 (from \$75 to \$113).